

REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

CEITEC - Central European Institute of Technology
Masaryk University
Kamenice 753/5
625 00 Brno, Czech Republic

2. Type of research institution: Public university (veřejná vysoká škola)

3. Head of the institution: Mgr. Jiří Nantl, LL.M. – CEITEC MU Director

4. Contact information of designated person(s) for applicants:

Doc. Mgr. Pavel Plevka, Ph.D. – Research Group Leader Senior, Deputy director for research infrastructure
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5. Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre:

Life Sciences: *Molecular biology, structural biology, biotechnology* - molecular biology, structural biology, biotechnology

6. Description of important research achievements from the selected discipline from the last 5 years including a list of the most important publications, patents, or other results:

Central European Institute of Technology (CEITEC) is a consortium of six academic partners that together cover a broad range of topics from life and materials sciences. CEITEC Masaryk University (CEITEC-MU) focuses on life science research. Its researchers tackle fundamental questions in structural biology, RNA biology, plant sciences, biomedicine and neuroscience. Particularly integrative **structural biology** is strong at CEITEC. It combines classical crystallography and NMR techniques with modern single particle cryo-electron microscopy (cryo-EM) approaches, in situ cryo-electron tomography, computational chemistry and molecular simulations. CEITEC-MU has during its build up phase invested strategically into high-end EM equipment and hired a strong group of PIs who apply cryo-EM approaches to study important biological questions in fields such as virology, transcription and translation. This critical mass of junior and senior researchers works synergistically and has achieved number of fundamental mechanistic insights into cellular processes [1-4]. The structural biology is productively interfacing with the other strong disciplines at the institute: the group of researchers working on **RNA biology** [5,6] and the **plant systems** [7,8]. Moreover, the connections to the technologically oriented Brno Technical University (CEITEC-BUT) consortium partner and the undisputed strength of Brno's EM industry, sets the stage for advanced technological development in the cryo-EM research arena. The goal of CEITEC is to further strengthen these synergies by attracting international research talent through the Dioscuri program.

- Skubnik, K.; Sukenik, L.; Buchta, D.; Fuzik, T.; Prochazkova, M.; Moravcova, J.; Smerdova, L.; Pridal, A.; Vacha, R.; Plevka, P. (2021) Capsid opening enables genome release of iflaviruses. **Science Advances** 7(1)
- Bárdu, P., Füzik, T., Hrebík, D., Pantůček, R., Beatty, J.T., Plevka, P. (2020) Structure and mechanism of DNA delivery of a gene transfer agent. **Nature Communications** 11, 3034
- Hrebík D., Štveráková D., Škubník K., Füzik T., Pantůček R., Plevka P. (2019) Structure and genome ejection mechanism of Staphylococcus aureus phage P68. **Science Advances** 5(10):eaaw7414
- Tuerkova, A., Kabelka, I., Králová, T., Sukeník, L., Pokorná, Š., Hof, M., Vácha, R. (2020) Effect of helical kink in antimicrobial peptides on membrane pore formation. **eLife** 9, e47946
- Gajduskova, P., de los Mozos, I.R., Rajecky, M., Hluchy, M., Ule, J., **Blazek, D.**, (2020) CDK11 is required for transcription of replication-dependent histone genes. **Nature Structural & Molecular Biology** 27, p. 500–510
- Rengaraj, P.; Obrdlik, A.; Vukic, D.; Varadarajan, N.M.; Keegan, L.; Vanacova, S.; O'Connell, M.A. (2021) Interplays of different types of epitranscriptomic mRNA modifications. **Rna Biology** 18(S1), p. 19 - 30
- Franek, M.; Kilar, A.; Fojtik, P.; Olsinova, M.; Benda, A.; Rotrekl, V.; Dvorackova, M.; Fajkus, J. (2021) Super-resolution microscopy of chromatin fibers and quantitative DNA methylation analysis of DNA fiber preparations. **Journal of Cell Science** 134(15),
- Valuchova S.; Mikulkova P.; Pecinkova J.; Klimova J.; Krumnikl M.; Binar P.; Heckmann S.; Tomancak P.; Riha K. (2020) Imaging plant germline differentiation within Arabidopsis flowers by light sheet microscopy. **eLife**. Feb 11;9. pii: e52546.

7. List of no more than 3 important research projects in the selected discipline awarded in national and international calls to the institution in the last 5 years:

Project title	Name of PI	Source of funding	Amount of funding	Project duration
Structural studies of human picornaviruses	doc. Mgr. Pavel Plevka, Ph.D.	ERC Starting grant	1 997 557 Eur	01.03.2014 – 28.02.2019
Dynamic assembly and exchange of RNA polymerase II CTD factors	prof. Mgr. Richard Štefl, Ph.D.	ERC Consolidator Grant	1 844 605 Eur	01.03.2015 – 29.02.2020
Peptide Killers of Bacteria	doc. RNDr. Robert Vácha, PhD.	ERC Consolidator Grant	2 491 955 Eur	01.01.2021 – 31.12.2025

8. Description of the available laboratory and office space for a Dioscuri Centre:

CEITEC-MU offers to all of its research groups an appropriate office space and laboratories based on the size of the group. For a starting research group, it is typically about 60 m². The laboratories are suitable for the research in the area of molecular biology and can be adjusted for specific purposes. There are also several laboratories that can be shared among Research Groups to ensure efficient capacity utilisation. A major advantage of CEITEC are the **in-house core facilities** (see below, point 9) that are also shared and give CEITEC investigators access to outstanding research infrastructure, advanced technologies and services at internationally competitive level. These include cryoEM and NMR with state of the art equipment for structural biology, proteomics, cellular imaging operating light sheet and superresolution microscopes, and NGS facility with capabilities for single cell sequencing. CEITEC is also investing heavily in further development of its core strengths in correlative light and electron microscopy.

Besides the advanced core facilities, CEITEC-MU laboratory space includes 2 laboratories with hygiene loop and facilities for waste decontamination in bsl3 mode; 3 laboratories with hygiene loop and facilities for waste decontamination in bsl2 mode; specialized laboratories for work with isotopes; tissue culture laboratories equipped with flow boxes for sterile work; laboratories with enhanced cooling for sample storage; bacterial culture laboratories; medical facilities (examination rooms and sampling points), facilities for decontamination of waste and washing of laboratory glassware; microscopy rooms equipped with a variety of microscopes, micromanipulators and other essential imaging equipment. There is also a server room, shared data storage facilities and associated IT services.

CEITEC-MU is housed in a **modern, newly built research building** that offers several shared meeting rooms equipped with relevant audio-visual technologies, to meet both on-line and in person. Apart from that, the building offers employees shared background space – relax zones and kitchens and a spacious atrium for public events such as lectures and meetings.

The CEITEC-MU building is embedded in the vibrant **campus of the Masaryk University** in Brno Bohunice with easy access to intense academic life, on-campus cultural events, sporting facilities, food courts and shopping.

9. List of the available research equipment for a Dioscuri Centre:

State-of-the-art research facilities are the pillar of CEITEC research and a key ingredient to realize its ambitious goal of becoming a research center of international significance. The **CEITEC 12 core facilities (CF)** are spread on more than 25 000 square meters. They offer research community at CEITEC, in the Czech Republic and also internationally, access to advanced research equipment that is often not found anywhere else in the country (particularly with respect to EM and nanotechnologies). The CFs are staffed with experts who work with CEITEC research groups on challenging, high-technology research projects. The reliance on the CF services enables CEITEC scientists to **focus on their research questions and think big in their formulation**. Most of the core facilities are members of national and international Research Infrastructure (RI) consortia which ensures their long-term and sustainable financing.

CF Biomolecular Interactions and Crystallization: key equipment:

- Crystallization robotics + automated plate storage and inspection; SPR, BLI, AutilTC, VP-ITC, VP-DSC; Microscale thermophoresis; Analytical ultracentrifuge; CD, DLS, D

CF Cellular Imaging: key equipment:

- Confocal microscopes (high-end / low-end); Super-resolution microscopes; Stereo & zoom microscopes; Widefield microscopes; Light sheet microscopes; Image processing workstations

CF Cryo-Electron Microscopy and Tomography: key equipment:

- FEI Titan Krios (80 - 300 kV) equipped with an energy filter and a direct detector camera; FEI F20 (200 kV) equipped with a CCD camera and a dual beam FIB/SEM instrument (Versa3D); Vitrification robot Vitrobot Mark IV; Thermo Scientific Talos Arctica (40 - 200 kV) equipped with Schottky field emission gun (XFEG), Falcon3 EC direct electron detector and Ceta camera

CF Nanobiotechnology: key equipment:

- Scanning probe microscope - Ntegra Vita / Solaris (NTMDT); Atomic force microscope NanoWizzard3 (JPK); ForceRobot 300 (JPK); Automated system SolverNEXT (NTMDT); Ink-jet based deposition system S3 (Scienion)

CF Josef Dadok National NMR Centre: key equipment:

- NMR spectrometer for high-resolution spectroscopy in liquids (600 MHz, 700 MHz, 850 MHz and 950 MHz); NMR spectrometer for high-resolution spectroscopy in liquids and solids (500 MHz and 700 MHz)

CF Proteomics: key equipment:

- LC-MS/MS systems: Q Exactive HF-X, Orbitrap Fusion Lumos Tribrid, Orbitrap Elite, Impact II, timsTOF Pro; MALDI-TOF/TOF MS: Ultraflextreme

CF X-ray Diffraction and Bio-SAXS: key equipment:

- Rigaku HighFlux HomeLab™ robotized macromolecular diffraction system with ACTOR sample changer optimized for work at Cu-K α wavelength; Rigaku HighFlux HomeLab™ universal, dual wavelength (Mo-K α and Cu-K α) diffractometer; Rigaku BioSAXS-1000 SAXS camera for small angle X-ray scattering from solutions of biological macromolecules

CF Bioinformatics: key equipment:

- Standardized data processing pipelines for NGS analyses

CF Genomics: key equipment:

- Massive parallel sequencers Illumina NextSeq and MiSeq; Microarray system Agilent SureScan; qPCR & digitalPCR; Flow cytometry; Single-cell

CF Plant Sciences: key equipment:

- Greenhouses; Phototrons; Small chambers; transgenesis

CF Multimodal and Functional Imaging Laboratory: key equipment:

- Two whole body MR scanners with 3T magnetic field induction; Equipment for functional studies; Electrophysiological systems for use in EEG laboratory or with MR

CEITEC Nano Research Infrastructure: key equipment:

- complex equipment for nanofabrication, nanocharacterization, structural analysis and X-ray tomography

10. List of the additional benefits (other than listed in the conditions for hosting a DC, see invitation) that the Institution declares to provide for a Dioscuri Centre (i.e.: additional funds, personal benefits, dual career options, relocation support or other):

CEITEC research group leaders receive **core funding** that is moderate in international comparison, however, higher compared to the conditions of the Czech Dioscuri program. The standard level of institutional support will apply to the prospective Dioscuri group.

Moreover, the **South Moravian Region** and the **City of Brno** have several ongoing research support schemes and are motivated to use them to attract a Dioscuri Center to Brno. These include:

- Brno PhD Talent – the City of Brno support for PhD scholarships in the amount of 400,000 € every year
- Junior Research Group Leader Programme (JRGL) which supports the creation of junior research groups at CEITEC with the total amount of 1 million €
- Support for academic spin-offs with a grant scheme *Prototype & Validate* which provides funding for commercially viable businesses. The scheme distributes roughly 500,000 € annually and is managed by the innovation agency JIC (**South Moravian Innovation Center**)

In addition, CEITEC is working closely with **regional electron microscopy powerhouse companies** on building a bridge between industry and academia in the area of correlative microscopy. Attracting international research talent is of high interest to the private sector.

CEITEC offers great conditions to employ excellent researchers. The institute values diversity and promotes an inclusive working environment with the aim to support the best scientists. The institute strives for scientific excellence and emphasizes **research quality over quantity**. CEITEC MU is a proud holder of the HR Excellence in Research Award by the European Commission (<http://muni.ceitec.cz/en/hr-strategy-hrs4r/>).

The institute administration is covering all areas of functioning of a modern scientific institution. Since CEITEC research relies heavily on third party funding, the institute runs a pro-active **Grant Office** supporting all aspects of grant preparation and management. CEITEC positions itself in the Czech and international scientific community with the help of a Communications office that is active on all modern communication channels including social media. Technology transfer support is covered by the **Technology transfer office** of MU. CEITEC operates a **Welcome Office** which provides comprehensive support for employees before and after their arrival to Brno.

A given is an attractive salary and benefits package (contribution to a pension scheme, flat-rate meal contribution, sports lessons directly at the campus, multisport card, reduced prices for mobile operator tariffs, special employee bank products, 6 weeks of paid holiday etc.).

11. Other information about the internationalization of the research institution, international researchers employed at the institution, the availability of English language seminars etc.:

The language of the institute is **English**. This applies to scientists as well as administration. CEITEC-MU is one of the successful recipients of the ERA chair H2020 funding. Prof. Mary O'Connell represents an established foreign senior scientist who was not only recruited to CEITEC-MU from abroad, but was also retained after the ERA chair funding expired.

In 2021, CEITEC-MU had 436 employees, 46 % of them were women and 41 % were foreign researchers. Particularly international is the **CEITEC PhD school** where the proportion of Czech students is consistently below 50%. Of the 165 ongoing funded projects, 25 are international, including two running ERC grants.

CEITEC-MU is a member of two significant international networks:

- **EU-LIFE:** its mission is to foster excellence, share knowledge, and influence policies in life sciences. Partners in EU-LIFE are renowned European research centers that operate with similar principles of excellence, external reviews, independence, competitiveness, and internationality
- **Alliance4Life:** a bottom-up initiative of twelve leading life science institutions from eleven EU-13 countries that aims at closing the divide in European health research and Innovation

CEITEC is one of the first institutions in the Czech Republic that uses **international Scientific Advisory Board (iSAB)** to evaluate the performance of its research groups and to make important strategic decisions. The expert input from established scientists is valued more than the bibliographic analysis of research performance. The iSAB contributes significantly to the internationalization of the scientific environment at CEITEC and its scientific culture.

Since 2015 CEITEC-MU is running a successful regular lecture series named **"Life Science Seminars"** (<https://seminarseries.muni.cz/life-sciences/about-the-series>) designed to bring renowned foreign researchers to the campus. Many of the visitors, in particular the Nobel Prize winners, present the prestigious **"Mendel Lectures"** at the Augustinian Abbey in Brno (<https://mendellectures.muni.cz/>). Other regular topical seminar series are Molecular Medicine seminars, Advanced Material and Nanotechnologies seminars and Bioinformatics Seminars (<https://www.ceitec.eu/events/>). CEITEC is holding numerous international conferences, practical course and summer schools often organized with support from international organizations such as EMBO. **Soft skill lectures** on various topics such as career development, research ethics and mental health complement the scientific events and are also held exclusively in English. All events are pushed to CEITEC researchers and the broader Brno academic community through a **weekly email newsletter** which demonstrates the richness of CEITEC academic life.